

### REQUEST FOR RECONSIDERATION

Claims 1-6 and 8-13 and 19-20 remain active in this application.

The claimed invention is directed to a process for the preparation of dendritic or hyperbranched polyurethanes, dendritic or hyperbranched polyurethanes and methods for producing reaction products of dendritic or hyperbranched polyurethanes.

Applicants wish to thank examiner Leonard for the helpful and courteous discussion held with their U.S. representative on September 9, 2010. At that time, applicants' U.S. representative argued that the claim limitation of "differing reactivity toward isocyanate groups" was based on reactivity differences which would allow for differential reaction, such as those occurring between primary, secondary and tertiary alcohols, a feature which was not disclosed or suggested in any of Perez et al. or Reich et al. which merely disclosed multiple hydroxyl groups, but **not multiple hydroxyl groups of differing reactivity towards isocyanate groups**. Further, that the general goals of polymer formation in terms of **substantially linear chains** did not suggest the claimed dendritic or hyperbranched polyurethanes. The following is intended to expand upon the discussion with the examiner.

Dendritic or hyperbranched polyurethanes have found industrial applicability but have suffered from costly and complex preparation techniques. Compatibility and solubility with or in standard solvents and with or in water can be an issue (page 3, lines 5-9 of applicants' specification). Simpler and less costly techniques for preparing such compatible and soluble polyurethanes are sought.

The claimed invention addresses this problem by providing a method for preparing dendritic or hyperbranched polyurethanes by reacting diols or polyols having **1) at least one tertiary nitrogen atom; and 2) at least two hydroxyl groups, having differing reactivity toward isocyanate groups**, with diisocyanates or polyisocyanates. Applicants have discovered that reaction of diols or polyols having **at least one tertiary nitrogen atom** and

**at least two hydroxyl groups having differing reactivity toward isocyanate groups** to provide a simple method for the preparation of dendritic or hyperbranched polyurethanes. Such a process and dendritic or hyperbranched polyurethane are nowhere disclosed or suggested in the cited reference of record.

The rejections of claims 1-6, 8-13 and 19-20 under 35 U.S.C. §103(a) over Reich et al. U.S. 4,786,682 and over Perez et al. each in view of Bruchmann et al. U.S. 6,376,637 are respectfully traversed.

The cited combination of references fails to disclose or suggest a process in which a polyol component having at least one tertiary nitrogen atom and at least two hydroxyl groups having **differing reactivity toward isocyanate groups**, is reacted with isocyanates in sequential steps.

Reich et al. describes a first step of reacting hydroxyl groups of a hydroxyl group containing polyester or polyether with (meth)acrylic acid (column 2, lines 4-7). The pendant acrylate groups are then reacted with a primary or secondary amino group containing compound in a Michael addition (column 3, lines 4-18). In addition to being a primary monoamine (column 3, lines 27-34), the compound having a primary or secondary amino group may also have a second amino group or at least one hydroxyl group (column 3, lines 35-44). Of the alkanol amines, only primary alcohols of ethanolamine, propanolamine and butanolamine are disclosed (column 3, lines 42-44). The polyether(meth)acrylates, polyester(meth)acrylates or epoxy(meth)acrylates containing at least **one** free hydroxyl group is then **reacted with isocyanates** to form linear urethane (meth)acrylates (column 3, lines 48-54). While there is a disclosure of a compound having at least one free hydroxyl group, there is no disclosure or suggestion of a compound having at least two hydroxyl groups having differing reactivity toward isocyanate groups.

Perez et al. identifies an ungelled Michael reaction adduct of compounds (a) of a material containing one or more primary and/or secondary amino groups and at least two hydroxyl groups, such as a dialkanolamine with compounds (b) having at least two  $\alpha,\beta$ -ethylenically unsaturated moieties. As compound (b), preferably is suggested ethylenically unsaturated materials as acrylate functionalities (column 2, lines 53-67). Suitable acrylate functional materials are identified as polyol polyacrylates of which polyesterpolyol polyacrylates are given as an example (column 3, lines 6-17). One method of preparing a polyesterpolyol polyacrylate would be to react a **hydroxyalkyl acrylate with a lactone** (column 4, lines 4-6), followed by reaction with a dicarboxylic acid in the formation of a polyester polyol polyacrylate. This polyester compound has **no hydroxyl groups** such that upon reaction with compound (a), a Michael addition product will not be formed having at least two hydroxyl groups of different reactivity.

In contrast, the claimed invention is directed to a process for preparing dendritic or hyperbranched polyurethanes by reacting diols or polyols having at least two hydroxyl groups having differing reactivity toward isocyanate groups with diisocyanates or polyisocyanates, in sequential reactions in which the higher reactivity hydroxyl groups are reacted in a first step and lower reactivity hydroxyl groups are reacted in a second step. By exploiting the differential reactivity the hydroxyl groups towards isocyanates, sequential reactions can be preformed in the preparation of dendritic or hyperbranched polyurethanes.

Applicants note that it would not be reasonable to interpret the claim to read on any polyol having a tertiary amine and multiple hydroxyl groups based on the theory that, absent a symmetry element, all hydroxyl groups would display some lack of equivalence in reactivity. The claims do not merely recite a difference in reactivity, but rather recites differences in reactivity **with isocyanates** and reaction of the more reactive hydroxyl groups in a first step and the less reactive hydroxyl groups in a second step. Accordingly those of

ordinary skill in the art would immediately recognize that the difference in reactivity is sufficient to allow for sequential reaction of the more reactive hydroxyl groups prior to reaction of the less reactive groups.

*Formation of Linear Polymer Chains Fails To Suggest Use In Forming Dendritic or Hyperbranched Polyurethanes*

As noted above, each of Reich et al. and Perez et al. are directed to forming polyols used to make conventional urethane coating materials (column 4, lines 62-66 of Reich et al. and column 8, lines 58-66 of Perez et al.) By reaction with isocyanates, **conventional linear urethane** coating materials are formed.

Accordingly, even if the polyol compounds of Reich et al. and Perez et al. were to contain hydroxyl groups having differing reactivity toward isocyanate groups, there is no suggestion that such differences in reactivity could be exploited in the formation of dendritic or hyperbranched polyurethanes in view of evidence of reacting such polyols in the **formation of linear polymer chains**. Since differences in reactivity hydroxyl groups are not disclosed **and** the reaction of the polyol components is in the formation of **linear polymer chains**, there would have been no motivation to use the polyol compounds of either Reich et al. or Perez et al. in the formation of dendritic or hyperbranched polyurethanes.

Even the reaction conditions of Reich et al. and Perez et al. fail to suggest formation dendritic or hyperbranched polyurethanes by sequential reaction.

Each of examples 1-12 of Reich et al. conducts reaction of isocyanate component with polyol for 5 hours at 80°C. The coating compositions of Perez et al. are applied to a surface and heated for 20-30 minutes at 121°C. Such reaction conditions fails to disclose or suggest formation of dendritic or hyperbranched polyurethanes by sequential reaction.

*Bruchmann et al. Fails To Suggest An Enhancement In Solubility By Inclusion Of At Least One Tertiary Nitrogen*

Bruchmann et al. fails to disclose a polyol component containing at least one tertiary nitrogen. Because of this deficiency the disclosures of Reich et al. and Perez et al. are applied. However, there is no suggestion that incorporation of a tertiary nitrogen would provide for enhancements in compatibility and solubility with or in standard solvents and with or in water.

*Reich and Perez Are Directed To Different Fields Of Polyurethane Chemistry from Bruchmann*

In previous official actions, it has been asserted that Bruchmann et al., Reich et al. and Perez et al. are from the same field of endeavor with respect to polyurethane products.

Such an assertion is an oversimplification of the field of polyurethanes.

Polyurethane products may differ based on their structure and application field.

Bruchmann et al describes dendritic or hyperbranched polyurethanes which usually have a high viscosity due to the structure. In contrast, Reich et al. describes urethane (meth)acrylates having very high reactivity on radiation and **at the same time a low viscosity** (column 1, lines 51-53). Thus, it can not be said that the references cited for combination are from the same field of endeavor, based on differences in properties. Quite simply, merely because similar chemical reaction are occurring does not mean that two references are directed to the same field of endeavor. Chemical are not reacted merely to cause a reaction, but in order to achieve a specific goal. If the goals are different, the nature of the filed of endeavor is also likely to be different. Therefore, given the different fields of endeavor, it would not have been obvious to use the Michael addition products of Reich et al. or Perez et al. to make a dendritic or hyperbranched polyurethane as described by Bruchmann et al.

In view of the deficiencies of the disclosures of the cited art, the claimed invention would not have been obvious and withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

Applicants submit that this application is now in condition for allowance and early notification of such action is earnestly solicited.

Respectfully submitted,

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